

## Cervical Spinal Cord Injury In A Term Baby: A Case Report

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### Abstract

Spinal cord injury in newborn is a rare but critical complication following difficult extraction during the delivery. The clinical presentations can be catastrophic, including severe respiratory distress and apnea requiring ventilatory support, varying degrees of sensorimotor loss, decreased or absent movement, areflexia, and a lack of response to painful stimulation. The outcome is usually fatal or severe, with long-term sequelae of respiratory insufficiency, limb weakness, or even paralysis of the limbs. We describe a female newborn with C1 spinal cord injury following a difficult vaginal birth undergoing therapeutic hypothermia. Neurological examination revealed absent reflexes and no respiratory effort and postwarming magnetic resonance imaging revealed a focal brainstem lesion with suspected medullary haemorrhage. Hypoxic ischaemic encephalopathy presenting with atypical neurological examination in the setting of a difficult extraction should prompt consideration of spinal cord injuries.

**Keywords:** Spinal cord injury, Birth related spinal injury, Therapeutic hypothermia, Hypoxic ischemic encephalopathy.

### Introduction

Spinal cord injury (SCI) is a rare and underdiagnosed condition that can result from difficult deliveries. It usually results from a strong traction force when the spine is hyperextended or when there is strong forceful longitudinal traction while the head is still firmly engaged in the pelvis or when body fails to turn with head during mid forceps rotations [1]. In cephalic presentations, the injury usually occurs at the level of the 4th cervical vertebrae, whereas in breech presentation, the lower cervical-upper thoracic vertebrae are usually affected [2]. The clinical presentation depends upon the extent of the injury to the spinal cord and includes respiratory depression, areflexia, loss of sensation and complete paralysis of voluntary motions. With severe injury, transections of cord may occur with or without vertebral fractures; other features being haemorrhage and oedema. Some new-borns may manifest signs and symptoms at birth with respiratory depression, shock or hypothermia and may deteriorate rapidly and die within several hours, whereas for others the course may be gradual and present later within the first week of life. The overall outcome for spinal cord injury is poor, with high morbidity and mortality. In asphyxiated new-borns who undergo therapeutic cooling, the diagnosis of spinal cord injury is sometimes challenging as they can occur concurrently. Regardless, spinal cord injury should be considered in any newborn with poor tone and respiratory effort at birth with or without a history of difficult delivery. Magnetic resonance imaging will demonstrate the extent and severity of the injury [3]. Early diagnosis of these injuries is vital for the long-term planning of the management by the parents and medical team.

### Case Report

A term baby girl weighing 3300gms was delivered at 39+4 weeks of gestation by forceps-assisted vaginal delivery following routine antenatal care. The labour was induced due to prolonged rupture of membranes of more than 48 hours. On delivery, the baby had two loops of tight cord around her neck. There was a difficult foetal extraction. The baby was born in a poor condition, pale, floppy with no respiratory effort. The Apgar scores were 2 at 1 min, 2 at 5 minutes and 4 at 10 minutes.

She received inflation and ventilation breaths at birth; however, due to poor respiratory effort, she was intubated and ventilated. On examination, she was hypotonic, had no spontaneous movement and had absent Moro reflex. Her pupils were symmetrical and reactive. She was hemodynamically stable. She was subsequently admitted to the Neonatal Intensive Care Unit for therapeutic cooling with a provisional diagnosis of HIE.

Cerebral function monitoring showed a normal continuous background, and her cranial ultrasound was normal. She completed 72 hours of therapeutic cooling in our unit. Following rewarming, her neurological examination revealed severe hypotonia. She had normal eye movements and was noted to suck on her ETT. She had minimal flexion of her toes in response to pain, very mild flexion (shudder) to painful stimulation of her finger and normal response to painful stimulus above level of cervical spine. She did not have respiratory effort and remained invasively ventilated. Her initial CK was high but normalised subsequently. Her Microarray and SMA genetics were

negative. She underwent an MRI brain on day 6 which showed non-specific generalised signal intensities but changes in keeping with haemorrhagic lesion in the medulla. A subsequent MRI with dedicated brain stem views confirmed haemorrhagic injury in the medulla/C1 region. A follow up MRI 3 weeks later confirmed a previous haemorrhagic ischaemic injury with significant cervical cord thinning. She was reviewed by the multidisciplinary team at our tertiary NICU. The decision was that the baby had a very poor prognosis, would not be able to maintain spontaneous respiratory function with only minimal voluntary movements of the limbs if any at all. It was felt that a tracheostomy was not in her best interests. The parents and medical team agreed to redirect care.

## Discussion

Spinal cord injury (SCI) is a rare and potentially underdiagnosed critical condition in the newborn, with an estimated incidence of 1 case per 29,000 [4]. SCIs have been documented in neonatal post-mortem studies in 10% to 14.9% of cases that included evaluation of the spinal cord. The spinal cord injury (SCI) is thought to occur secondary to excessive extraction, rotation, or hyperextension of the neck during delivery; as such, shoulder dystocia, breech position, and forceps or vacuum assistance have emerged as risk factors for neonatal SCI [5]. Neonates are at higher risk for these types of injury because of lax ligaments, weak muscles, and incomplete mineralization of the vertebrae [6]. Advances in diagnostic imaging that improve the accurate estimation of foetal size and presentation and the use of caesarean birth to avoid difficult deliveries has reduced the incidence of SCI related to obstetrical manoeuvres. SCI can occur in utero, at birth, and even in the nursery setting after birth.

The signs/symptoms and prognosis are dependent on the level of cord affected and the extent of injury. The upper and middle cervical spine are injured mostly in cephalic delivery, and the lower cervical and upper thoracic region are more common in breech delivery. The clinical manifestation of SCI in this population can be significant, with a ranging spectrum of sensorimotor deficits and sometimes apnoea, necessitating prolonged ventilation.

Diagnosis is based on the level, extent, and nature of the lesion as established by clinical examination, diagnostic imaging, and electrophysiological data. Diagnosing SCI in new-borns is challenging due to the wide range of differential diagnoses and associated problems. Common initial misdiagnoses include hypoxic ischemic encephalopathy, neuromuscular disorders and sepsis, which were also the initial diagnoses in our patient. Therapeutic hypothermia and

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investigative workup were undertaken to look for the underlying causes. However, the Magnetic Resonance Imaging (MRI) after the rewarming revealed evidence of cervical cord injury. Case reports by Arnaez et al. and Yokoi et al. describe babies also undergoing therapeutic cooling with follow up MRI revealing cervical cord injury [7]. Pamphlett and Cala demonstrated that babies with quadriplegic paralysis and no spontaneous breathing had the worst outcome, and despite therapeutic hypothermia, the prognosis was fatal [8]. Chien-Chung Lee et al. reported a baby with milder symptoms and monoplegia, which improved after steroids and therapeutic hypothermia.

Spinal cord injury may masquerade as neonatal encephalopathy, and co-existing hypoxic ischemic encephalopathy has been reported in up to 64% of affected infants. Our baby received therapeutic hypothermia following the initial diagnosis of HIE. The cerebral function monitoring was normal and not in keeping with HIE. Following rewarming the neurological examination was atypical notably no return of spontaneous respiration and severe hypotonia in an alert child with normal facial features and no cranial nerve involvement. The initial differential diagnosis was SMA and a neuromuscular disorder hence genetics for SMA and CPK levels were sent.

The initial MRI findings were non-specific and it was difficult to delineate the spinal cord injury requiring a high index of suspicion and subsequent dedicated spinal cord MRI views. The MRI will allow prognostication and further management. In our case a repeat MRI 3 weeks later allowed us to confirm whether there was resolution of the haemorrhage as opposed to ischaemic atrophy.

## Conclusion

We present a case of spinal cord injury following difficult vaginal extraction. The initial diagnosis was HIE and following therapeutic hypothermia an atypical neurological examination and MRI showed a focal hemorrhage in the brainstem and medulla with subsequent atrophy. The baby showed no recovery of spontaneous respiration therefore redirection of care was undertaken in partnership with the parents.

## Learning points:

1. Birth-related spinal cord injury should be suspected and recognized to initiate the neuroprotective pathways and avoid further neural damage.
2. MRI is a key diagnostic modality and should be performed to identify the injury and guide for further management.

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